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# **ECS Internal Stress Reaction Drill-Down**

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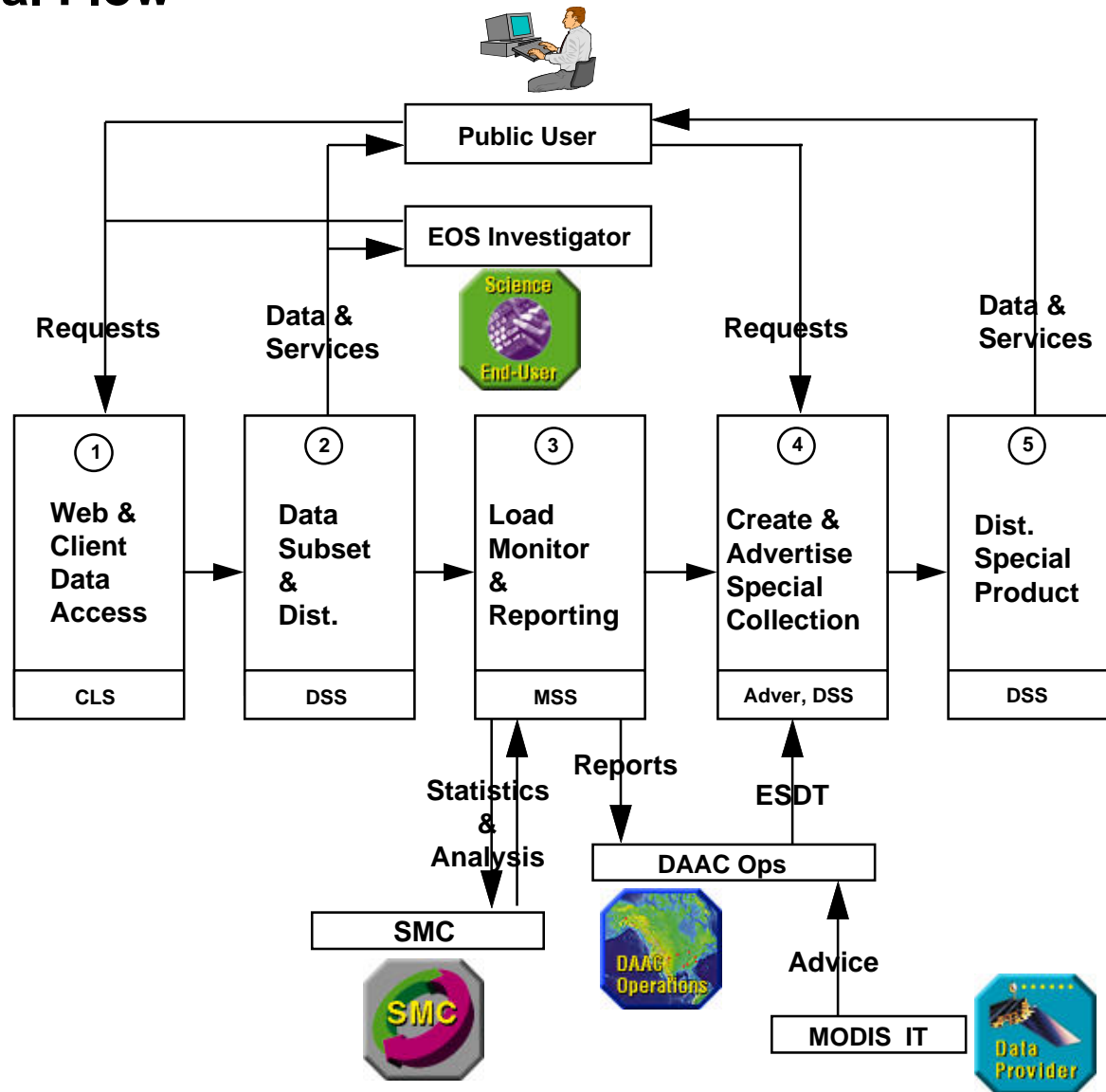
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# Spectacular Event

## Functional Flow





# Overview

**The ECS design contains mechanisms for graceful degradation. These mechanisms execute only when the system is stressed; that is, the load exceeds the maximum specified operating load. This drill down describes these mechanisms, which exist in most ECS subsystems.**

- **Sessions are limited in number**
- **Resources are controlled per external user session**
- **Network traffic is flow-controlled**
- **Application-level mechanisms automatically throttle load, and alert operators to take manual action when thresholds are crossed**
- **Performance data is collected from all applications via management agents and presented at the LSM Management Workstation.**

## Scenario Context

- **Spectacular geophysical event (oil spill) leading to a large number of requests for an image of the event.**



# Load Control Mechanisms By Scenario

Subsystem	Reports Performance Stats To LSM	Session Management	Distribution Server Cache	Operator Alerts	User Resource Management	TCP Flow Control	Staging Disk Request Queue	Partition Large Requests	On - Demand Quotas	Manual Hold Or Suspend Jobs	Session Suspend	Resource Reallocation
<b>Push And Pull Scenarios:</b>												
Spectacular Event	X	X	X	X	X	X	X				X	
Huge Data Request	X	X		X	X	X	X	X		X		X
High Priority Data Request	X	X			X	X	X		X	X		X
Science Software Error	X	X		X	X	X	X			X		X
<b>Push Scenarios:</b>												
Data Collection & Services Definition	X					X						
Science S/W Integration & Test	X					X			X			X
Calibration & Validation	X				X	X						
EDOS L0 Ingest & L1 Standard Production	X				X	X						X
Resource Planning For Reprocessing	X				X	X	X					X
Mode Mgmt & Software Fault Handling	X				X	X			X			
Cross-Site Schedule Conflict	X					X	X					
Data Collection Extensions	X					X						
<b>Pull Scenarios:</b>												
Advertising Service	X	X				X						
Quick Access	X		X			X					X	
Coincident Search	X		X			X					X	
DAR	X					X					X	
Resumption Of a Disconnected Session	X	X				X					X	

# Design Drivers



**Driving Requirement is that system must continue to function under stress, and integrity of data must not be lost, but performance may degrade temporarily.**

- **Orders may take longer to be serviced**
- **Pull requests may be rejected till system is less busy**
- **Operator intervention may be called for.**

# Sessions



- **Standard session server model is reused by most ECS servers including:**
  - the Advertising Server
  - the Data Dictionary
  - LIMs and DIMs
- **The number of active sessions is DAAC configurable as follows:**
  - total number of external user sessions
  - percentage of external user sessions that are guest sessions
- **Internal ECS clients have highest priority. For example Science Data Server will not reject session requests from Production or Ingest.**
- **Sessions can be suspended, without loss of data, by the user or by the operator.**
- **Resource Usage is controlled for external user sessions:**
  - working storage
  - number of bytes moved
  - number of tapes
- **Reference DID 305 Vol 24 (305-CD-024-001)**

# Networks



- **Release B separates push and pull flows within a DAAC by adding a dedicated network to support large data transfers between production and Data Server (see DAAC LAN Architecture Drill Down).**
- **Network loading is driven by applications, but TCP (the transmission protocol used for most ECS traffic) regulates flow such that there is a limit on the amount of data that can be sent without acknowledgment from the receiver. TCP preserves data integrity and guarantees delivery.**
- **Network slows as load increases. HP Openview and other monitoring tools provide both summary and detailed data on network loading.**



# Application Resilience - Data Server

- **Science Data Server caches data so that multiple requests for a product (such as an image of a spectacular event) within a time interval do not cause repeated archive accesses.**
- **Staging Disk storage is partitioned into read-only and read-write segments. The segment sizes and thresholds are DAAC-configurable. When a request for storage would cause a threshold to be crossed, the request is either queued or rejected.**
- **Large individual requests are partitioned (See Partitioning Large Requests Drill Down).**



# Application Resilience - Production



- Registered users have a limit per their user profile on the number of on-demand jobs they can submit.
- Additionally, the Planning CI imposes an overall quota for on-demand processing jobs per planning period. When the quota is reached, any additional on-demand requests are added to the queue.
- AutoSys will alert the *Production Monitor* if a job is not started or finished within a specified interval of the expected time.
- The *Production Monitor* will hold certain jobs when the system is stressed.
- If a particular Data Server is stressed, the *Resource Planner* will notify Planning (via a “ground event”) that the particular Data Server is not available to support production. Planning will then replan and reseed the job schedule with jobs that do not require access to that Data Server.



# Load Control Features By Subsystem

Subsystem	Reports Performance Stats To LSM	Session Management	Distribution Server Cache	Operator Alerts	User Resource Management	TCP Flow Control	Staging Disk Request Queue	Partition Large Requests	On - Demand Quotas	Manual Hold Or Suspend Jobs	Session Suspend	Resource Reallocation
Data Server	X	X	X	X	X	(X)	X	X			X	X
Ingest	X	X		X		(X)				X	X	
Planning	X	X		X		(X)			X			X
Data Processing	X	X		X		(X)				X		
Client	X	X		X		(X)						
Interoperability	X	X		X		(X)					X	
Data Management	X	X		X		(X)					X	
Management Subsystem	X	X		X	X	(X)	X	X		X		
Communications Subsystem	X	X		X		X						

X = mechanism is part of this subsystem.

(X) = mechanism is not part of this subsystem but is used by it.

# Evolutionary Features



## Potential future enhancements:

- **Asynchronous Transfer Mode (ATM) technology for network will allow flows to be controlled by class of service.**
- **Cross-DAAC sharing of resources when under stress.**

# Summary



**System design contains features that provide resilience to stressful loading.**

**System is tunable to achieve maximum throughput.**

**Degradation is graceful, via:**

- **Automatic mechanisms**
  - rejection of additional low-priority work, such as guest sessions
  - increased time to fulfil orders
  - queueing of on-demand processing jobs beyond quota.
- **Man-in-the-loop mechanisms**
  - alerts, enabling the operator to act to reduce low-priority tasks
  - suspension of sessions
  - replanning production to avoid use of a stressed resource.